



enhance

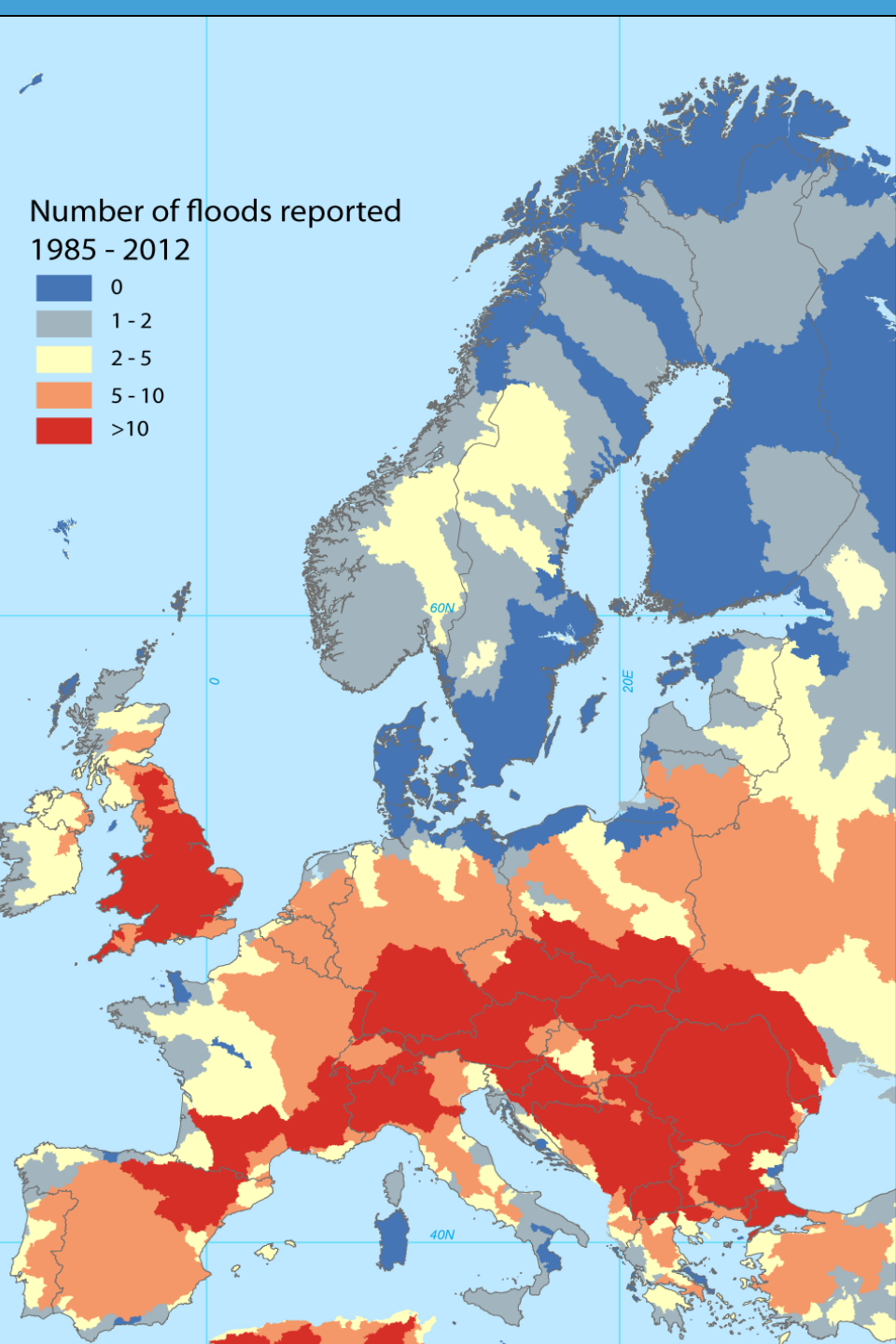
Partnership for Risk Reduction



Increasing stress on disaster risk finance due to large floods

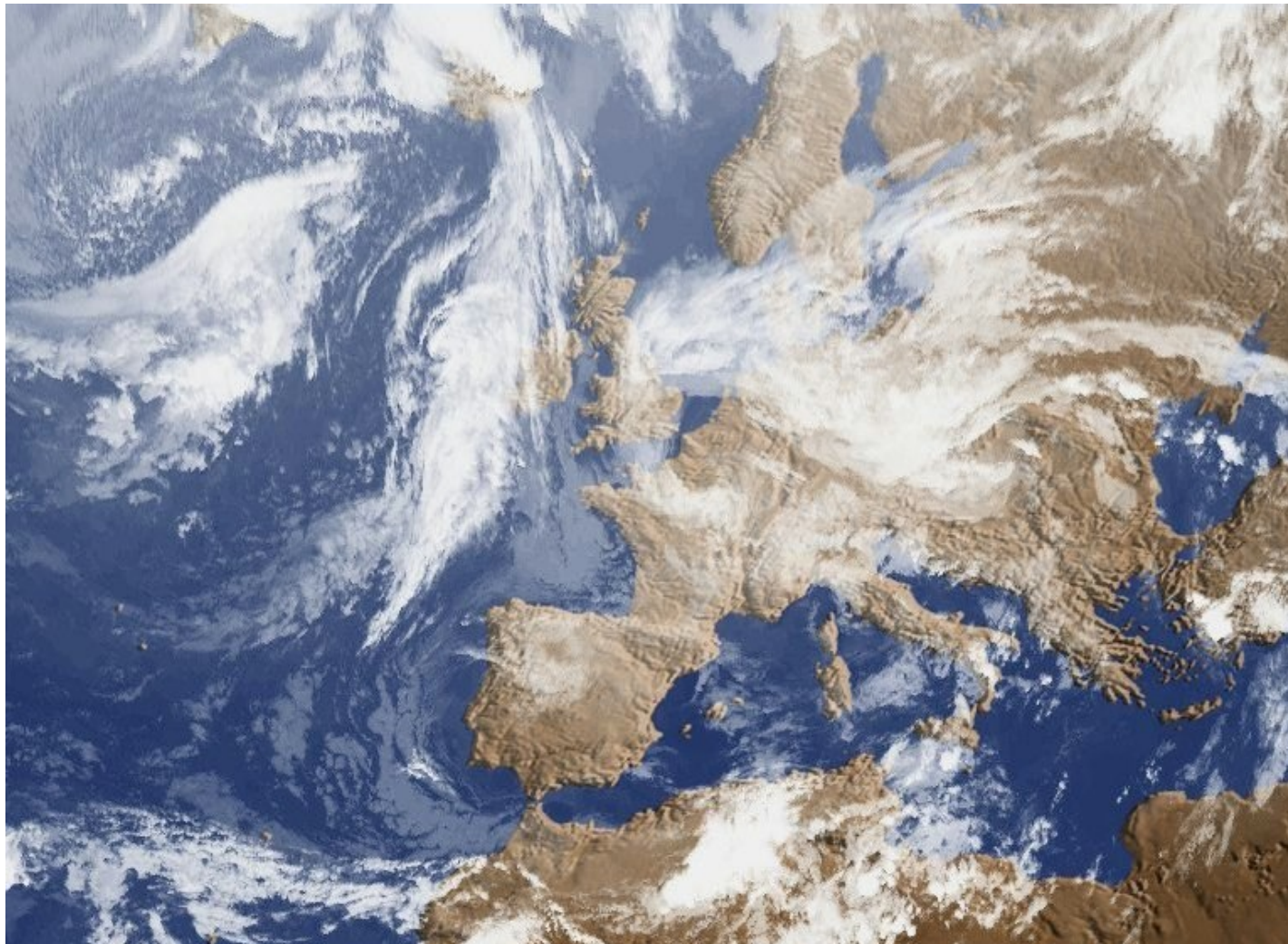
Brenden Jongman, Stefan Hochrainer-Stigler, Luc Feyen, Jeroen Aerts, Reinhard Mechler, Wouter Botzen, Laurens Bouwer, Geora Pflua, Rodrigo Roias & Philin Ward



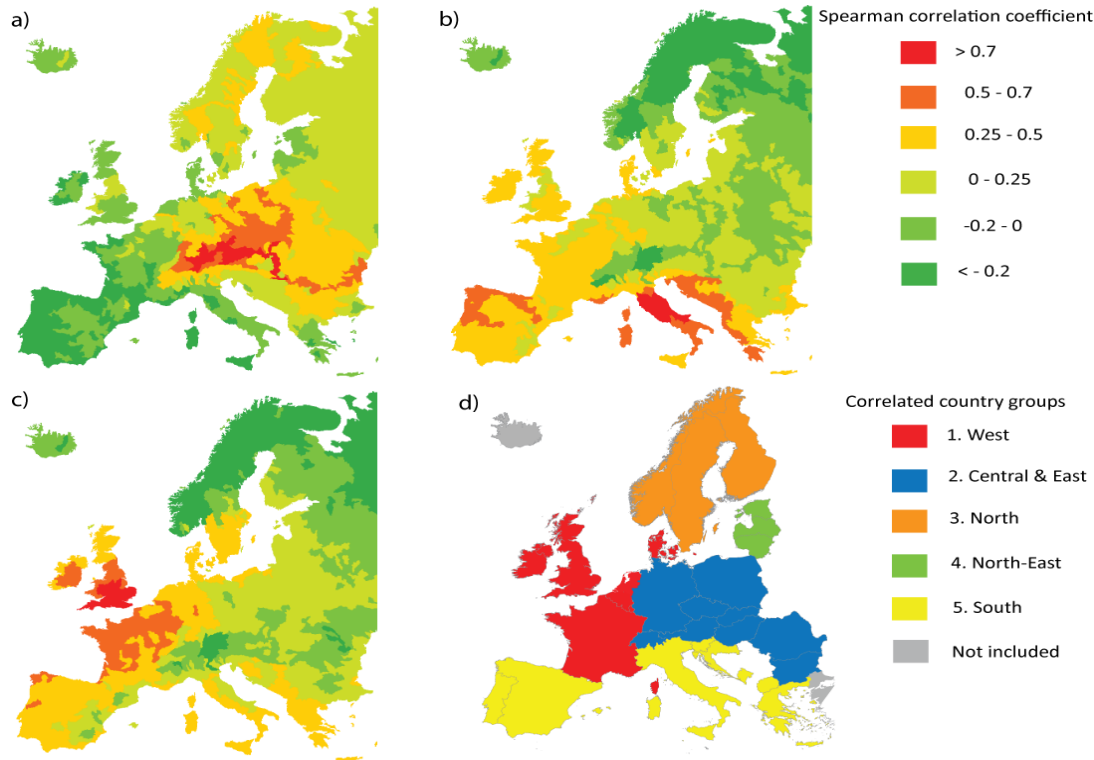


- What is the chance that damaging floods happen in **different countries at the same time**?
- What is the current **probability of extreme total losses** and how will this change?
- How can we **finance and reduce** these risks, taking into account **solidarity, equity and acceptability**?

Floods driven by large atmospheric patterns



Incorporating correlated risks

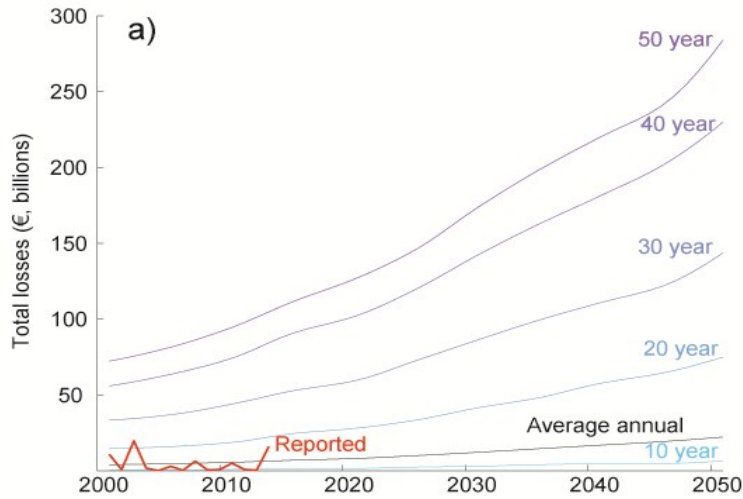


Flood risk across countries is **correlated** due to atmospheric patterns and river systems



Jongman et al., *Nature Climate Change*, 2014

Probabilistic trends in European flood risk



Options for risk sharing and reduction



Physical flood protection

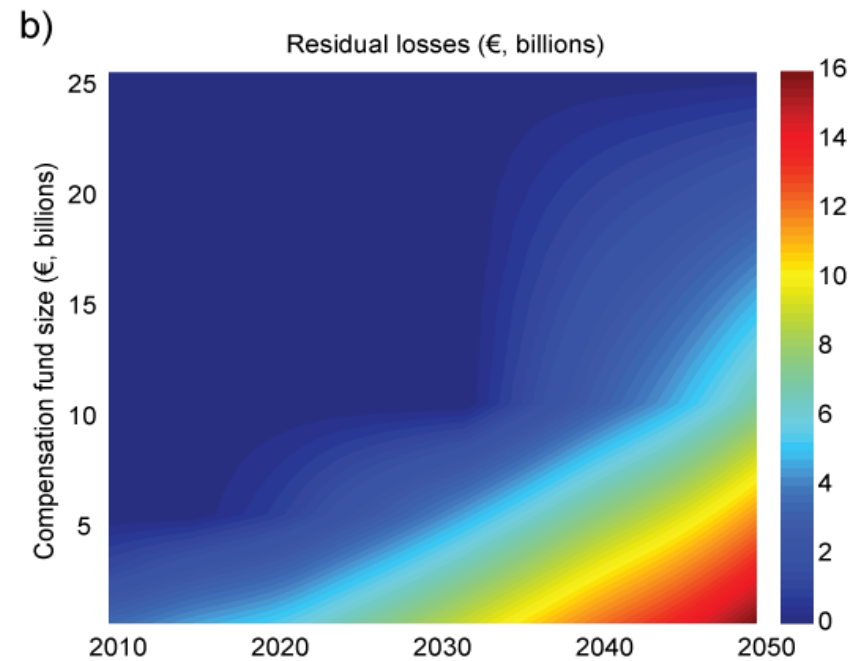


Insurance and compensation

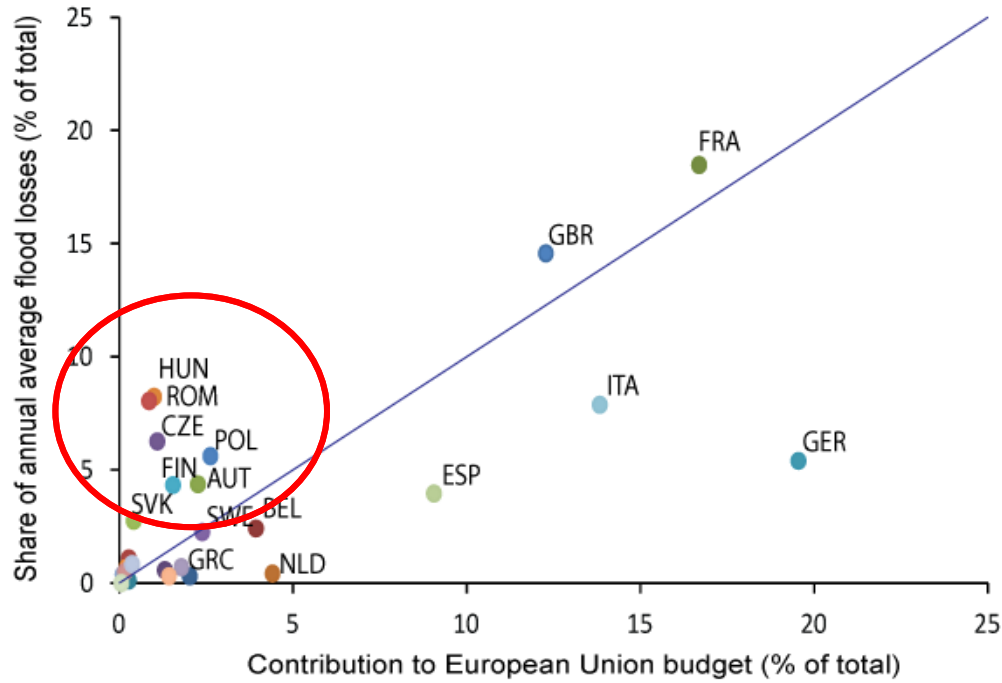


Reducing and financing losses

Or more European solidarity?



But.. who pays and who benefits?

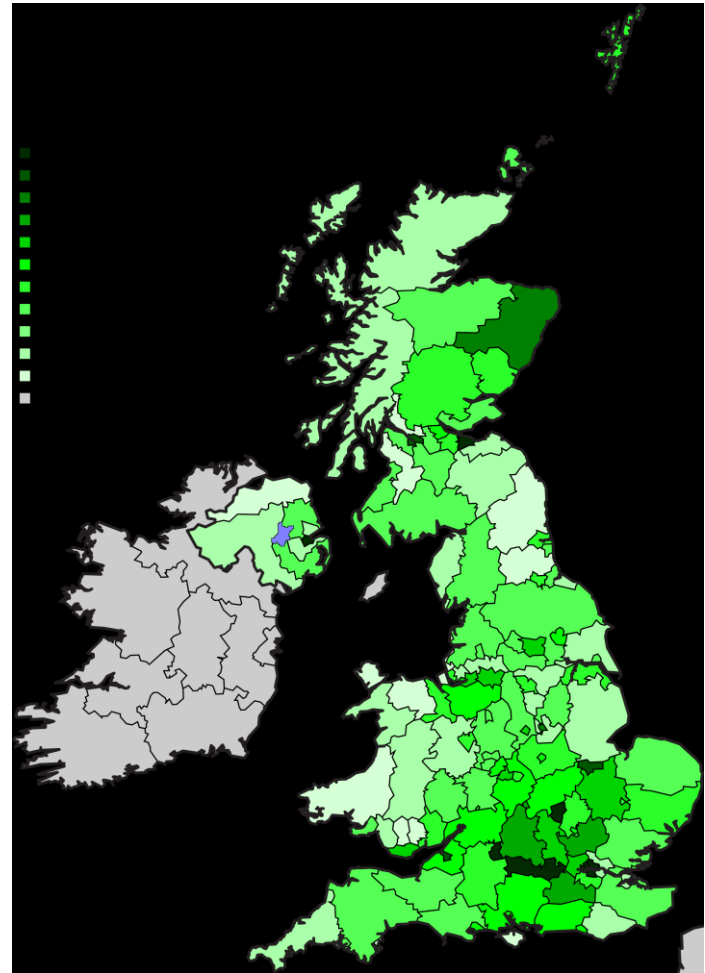
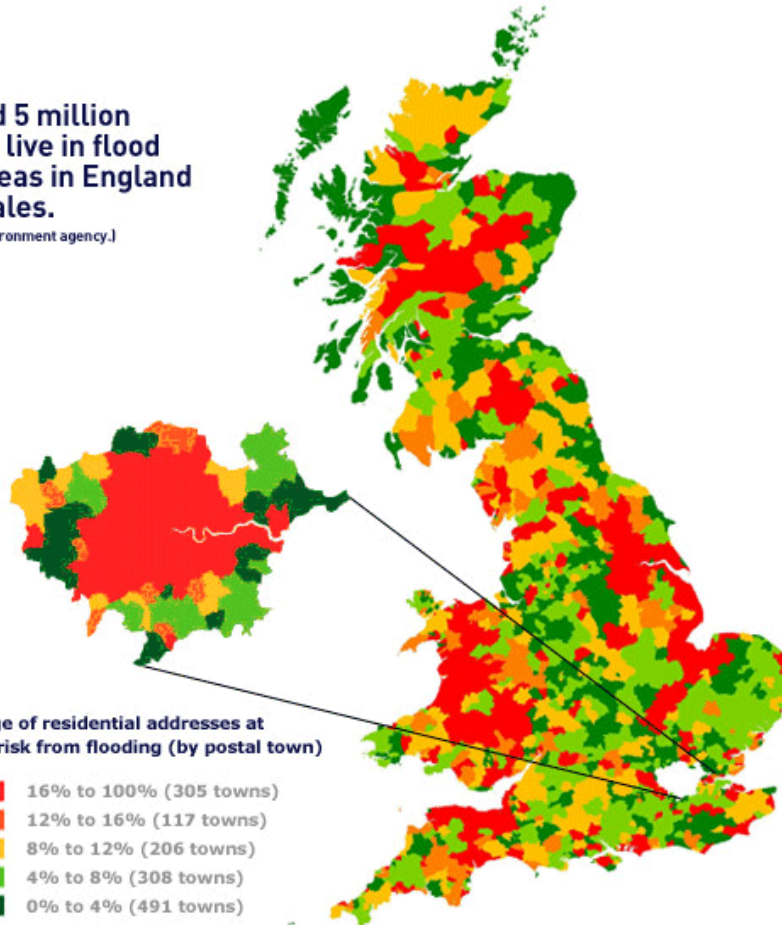


Solidarity is relevant at all spatial scales



Around 5 million people live in flood risk areas in England and Wales.

[source: Environment agency.]



Incentives are key



Should be I of preparing?

Nah...



NOW

Future

I must of asking EU for monies for reparations.



Managing increasing risks

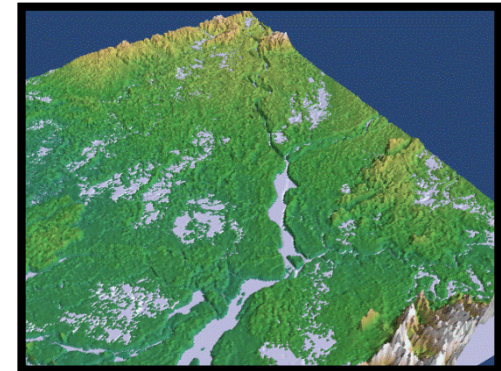
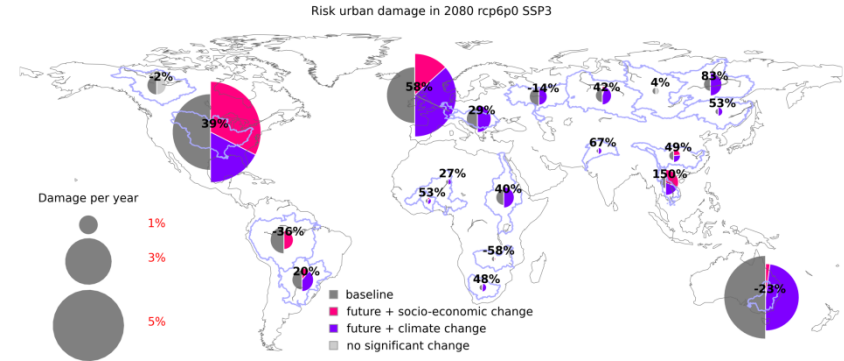
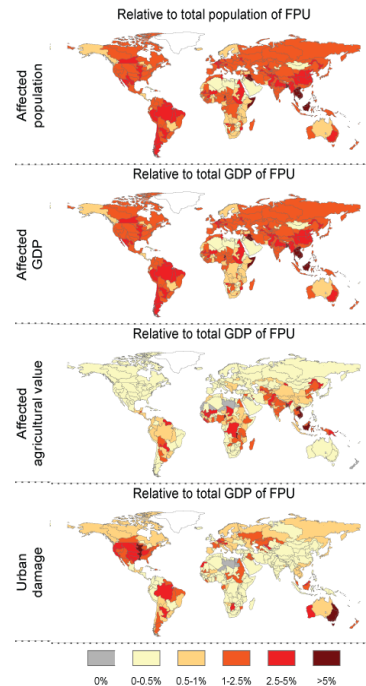


- Adaptation options have **different efficiency, equity and acceptability implications**
- Emphasis should be placed on **incentivizing risk reduction**
- Physical protection measures, insurance schemes and public solidarity funding are **complementary measures** and should be optimized in harmony
- **Risk correlations should be taken into account** in international risk reduction and risk financing initiatives

Towards global scale adaptation



Users



GLOFRIS

Global Flood Risk Assessment Tool: current & future risk at 1 km resolution

Developed by: IVM-VU University Amsterdam, Deltares, Utrecht University & Netherlands Environmental Assessment Agency (PBL)

Flood risk and intervention analyzer



Rhine

Back to map

Estimated annualized flood damage

Damage

Population

Urban damage

\$13M

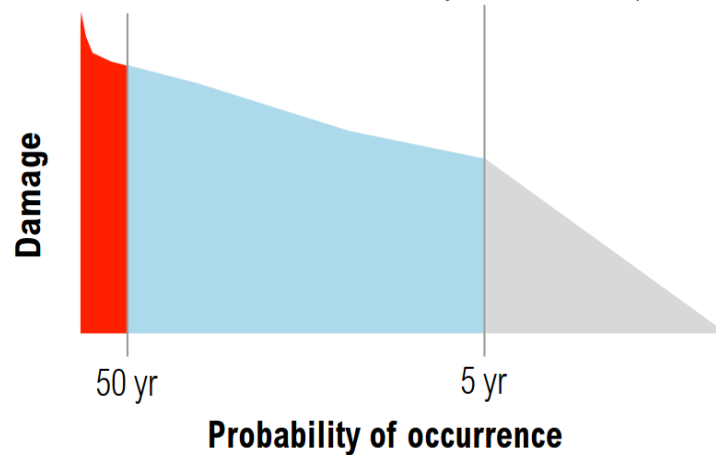
annualized flood damage

\$50M

avoided annually by increasing protection from 5 to 50 yr events

\$7M

avoided damage with current protection



Many rivers have flood management systems that are not measured in this tool. In developed countries, protection systems may be designed to withstand a 100 yr or greater flood.

Input a flood protection level to see its effect on estimated damages.

Next: analyze flood protection

Assumed current level:



5 yr

With additional protection:



50 yr

enhance

Partnership for Risk Reduction



Thank you for your attention

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Further reading:

Jongman, Hochrainer-Stigler, Feyen, Aerts, Mechler, Botzen, Bouwer, Pflug, Rojas & Ward. Increasing stress on disaster-risk finance due to large floods. *Nature Climate Change* 4, 264–268 doi:10.1038/nclimate2124 (2014)

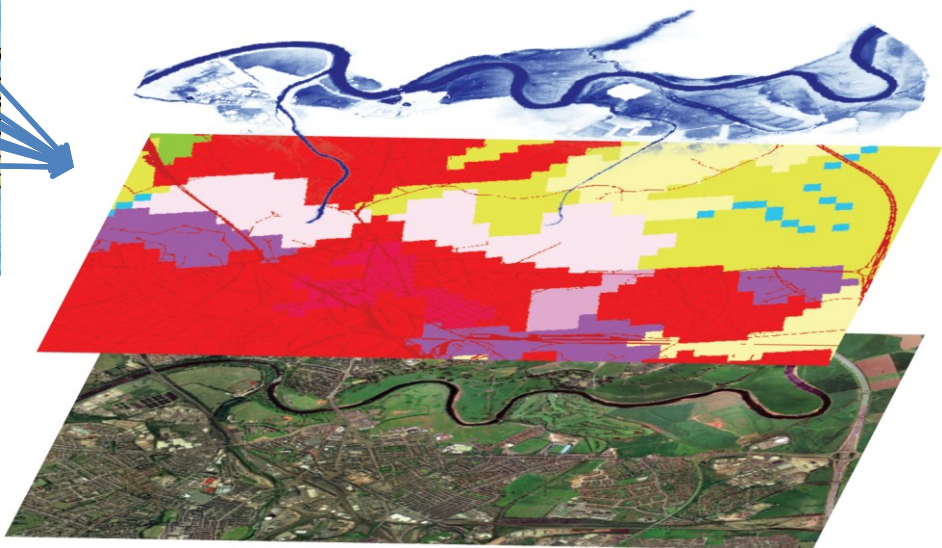
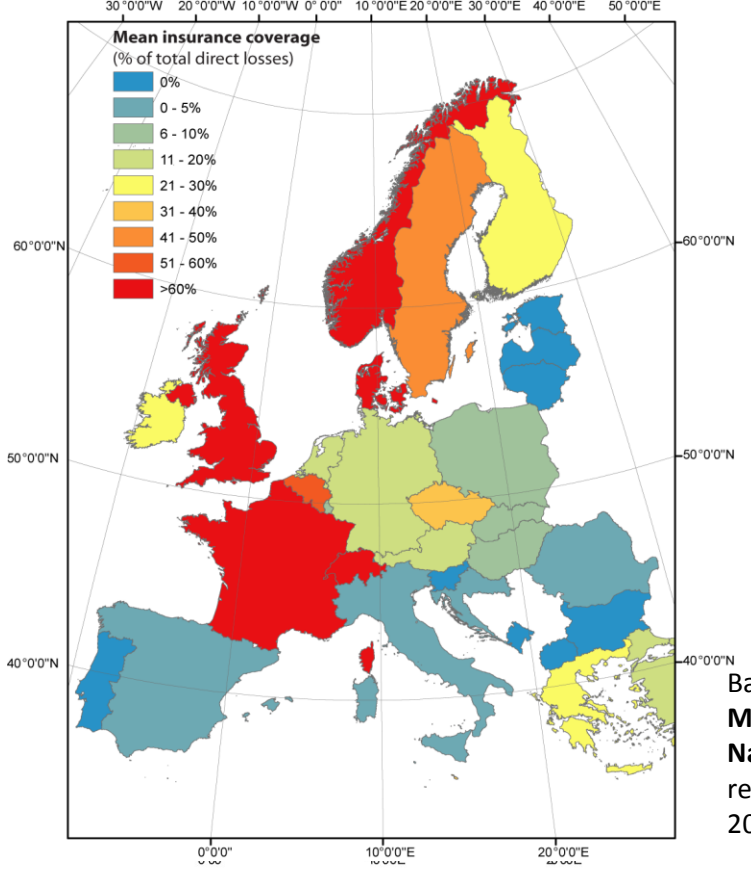
Trends in European flood risk

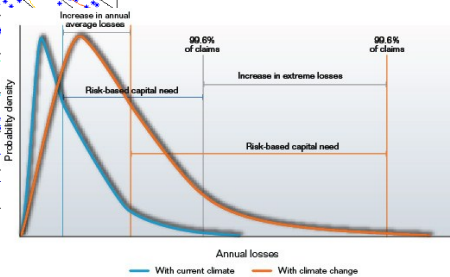
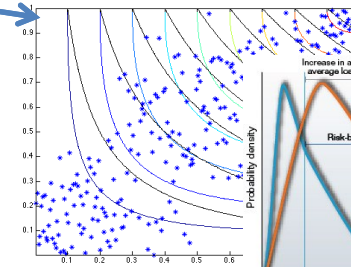
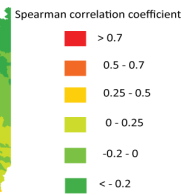
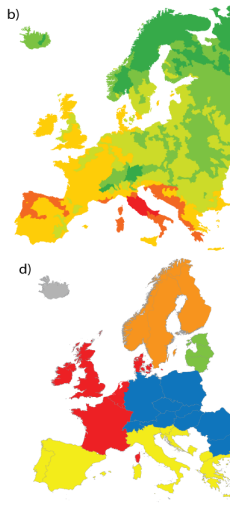
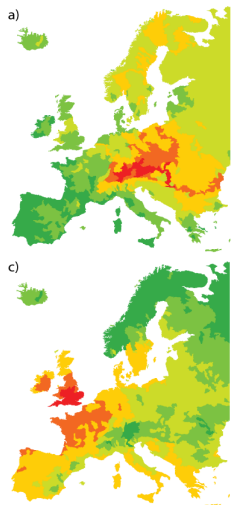
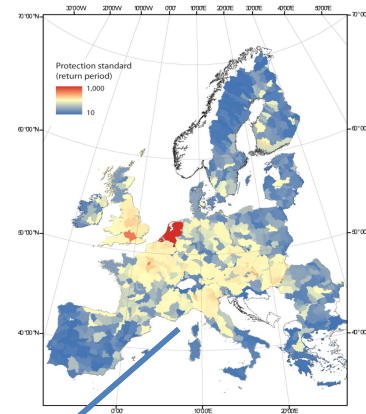
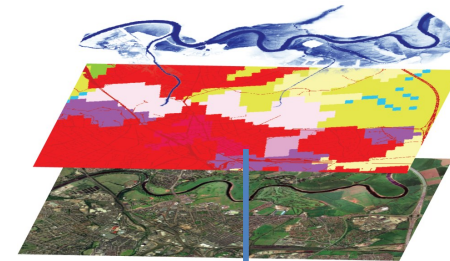
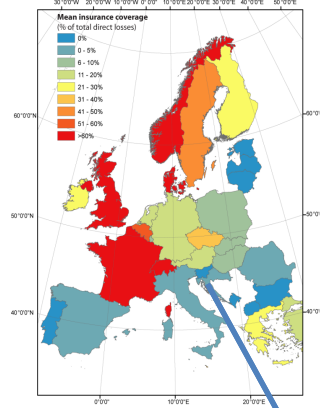


- Increase in expected losses, especially for extremes
 - 2/3 due to socioeconomic growth, 1/3 due to climate change
- Strong rise of 1/200 insured loss (Solvency II capital requirement)
 - from ~€ 116 billion in 2013 to ~€ 236 billion by 2050
- EU Solidarity Fund budget increasingly prone to depletion
 - regional differences in risk may lead to subsidizing effects

Location	Country	Estimate from literature	Source	Estimates from model	
				Exact location	Range in vicinity
Styria region	Austria	~100	46	51 - 162	
Kopenhagen	Denmark	>120	48	151	30 - 170
Carlisle	England	100 - 200	49	158	127 - 158
London	England	75 - 1000	48	500	230 - 500
Thames river - other	England	0 - 100	50	153 - 233	
Hamburg	Germany	~650	48	154	127 - 154
Köln	Germany	200	51	151	149 - 158
Central Danube	Hungary/ Romania/ Bulgaria	'Low' - 100; higher in cities	46	25 - 190	
Dublin	Ireland	~70	48	150	50 - 150
Cremona	Italy	200	52	155	152 - 185
Naples	Italy	20 - 50	48	28	28 - 128
Meuse river	Netherlands	250 - 1,250	47	1,000*	1,000*
Glasgow	Scotland	<150	48	107	52 - 150

Supplementary Table 2 | Validation of estimated flood protection standards





— With current climate — With climate change

Correlations might change with seasons, and could be influenced by climate change

